IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT
APPEALS & INTERFERENCES

IN RE APPLICATION OF

Joseph Hummel

#33
A.A.
1-14-99

Serial No.: 08/424,223 Art Unit: 3503

Filed: April 19, 1995 Examiner: J. Hail

For: KNITTABLE YARN AND SAFETY APPAREL

Docket: 10-142C3

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Assistant Commissioner for Patents
Washington, D.C. 20231

APPELLANTS' BRIEF

I hereby certify that this paper is being deposited with the U. S. Postal Service as 1st Class Mail addressed to the Assistant Commissioner of Patents, Washington, D. C. 20231 on 12/17/98.

By: Ellen M Gryleh

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Real Party in Interest

The real party in interest is Whizard Protective Wear Corp., through assignment from Bettcher Industries, Inc.

Related Appeals and Interferences

Parent abandoned application 06/788,385 filed October 17, 1985 was involved in interference no. 202,100. Appellant does not believe the interference will directly affect or have a bearing on the Board's decision in the pending appeal. Appellant was junior party. The interference was decided in favor of the senior party. The count was directed to a cut-resistant yarn utilizing a wire core, a core strand of high strength stretched polyethylene and two wrappings, one being of high strength stretched polyethylene. High strength stretched polyethylene has a tenacity much greater than 10 grams per denier.

The following appeal which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal is: Appeal in Serial No. 08/468,880, filed June 6, 1995.

Status of Claims

Claims 1-36 are pending.

Claims 4, 7-10, 13, 14, 19-24 and 27-34 are withdrawn from consideration.

No claims are allowed.

Claims 1-3, 5, 6, 11, 12, 15-18, 25, 26, 35 and 36 are finally rejected.

Claims 1-3, 5, 6, 11, 12, 15-18, 25, 26, 35 and 36 are appealed.

Status of Amendments

An amendment after final rejection was filed along with a supplemental Rule 132 declaration. The amendment was not entered. The supplemental declaration was considered.

Summary of Invention

The invention defined in the claims involved in this appeal is a cut-resistant yarn suitable for machine knitting, and safety garments, such as cut-resistant gloves, made from the yarn.

Yarns covered by the claims involved in this appeal are shown in Figures 1-6 of the drawings and a glove made from any of the yarns is shown in Figure 7. The differences between the yarn constructions shown in Figures 1-6 are not pertinent to the claims on appeal, and the invention of the claims on appeal will be described in connection with the yarn B of Figure 1, the elected species. All of the claims on appeal are either generic to the species disclosed or read on the species of Figure 1.

The present invention provides a cut-resistant, knittable composite yarn that utilizes a yarn or fiber strand or component of normal strength, made from Vectra liquid crystal polymer, to provide a composite yarn of comparable high cut-resistance to composite yarns of similar construction that utilize high strength synthetic yarn or fiber. The normal strength yarn or fiber utilized in the invention is sold by Hoechst Celanese Corporation, Charlotte, North Carolina, under the name Vectran M. For purposes of definition, normal strength fibers or yarns are those having a tenacity of no more than 10 grams per denier and high strength yarns or

fibers are those having a tenacity greater than 10 grams per denier, and typically 20 grams per denier or greater; e.g., aramid (Kevlar), extended chain polyethylene (Spectra) and high strength liquid crystal polymer (Vectran HS) all have a tenacity greater than 20 grams per denier. Tenacity is the tensile strength when expressed as force per unit linear density of the unstrained specimen. High strength yarns or fibers also have higher tensile modulus than normal strength fibers, for example, at least 500 grams per denier. The above-mentioned high strength fibers have been recognized and utilized for their characteristic of high cut-resistance, resulting in an association of high tenacity with high cut-resistance.

Vectran M is a normal strength liquid crystal polymer fiber that has a tenacity of about 9 grams per denier and a tensile modulus of about 425 grams per denier. It has better abrasion resistance than high strength aramid fiber such as Kevlar and significantly better heat resistance than high strength stretched polyethylene fiber, such as Spectra, thus overcoming a different shortcoming of each of Kevlar and Spectra for use in a cut-resistant yarn used for apparel and particularly for cut-resistant gloves. At the same time, quite surprisingly, this normal strength synthetic material provides the substantial advantages that high strength synthetic fibers such as Kevlar, Spectra and Vectran HS have over other normal strength materials in terms of cut-resistance and other characteristics in a composite yarn. Thus, knit fabric suitable for gloves and other safety garments utilizing Vectran M fiber not only has comparable cut-resistance, but also has greater resistance to self-abrasion than similar fabric made with aramid fiber or a combination of aramid and nylon fiber, yet is itself nonabrasive and comfortable to wear. Further, such fabric can be laundered at high temperatures conventionally used for industrial fabrics without degrading the

fabric, as occurs with cut-resistant fabric made from yarn that includes high strength stretched polyethylene. In addition, Vectran M has comparable or lower elongation under load to that of high strength fibers, which is advantageous when used in combination with a wire core strand in forming a composite yarn because it protects the wire strand from being broken during knitting or other sharp bending of the composite yarn. Vectran M is considerably less expensive than Vectran HS, presently about one-half the price.

The yarn B, shown in Figure 1 of the drawings and described in the specification at page 9, line 25, through page 11, line 17, comprises a core part 10 and three wrappings 12, 14, 16 of synthetic fiber wound about the core in opposite directions, each successive one on top of the previous one. The fact that each successive wrapping 14, 16 is in a different direction from the previous one balances the forces incident to the wrappings so the yarn has no unusual twist or tendency to coil and assists in holding the wrappings in place on the core 10. The core 10 has a strand 18 of 900 or 1500 denier multifilament liquid crystal polymer fiber having a tenacity no greater than 10 grams per denier, such as Vectran M, and a fully annealed stainless steel wire 20, 0.003 inch in diameter. The wrapping 12 is a strand of 440 denier multifilament liquid crystal polymer fiber having a tenacity no greater than 10 grams per denier and wrapped at a rate of 8-10 turns per inch about the core, and the wrappings 14, 16 are each 420 denier nylon wrapped at the rate of 8-12 turns per inch, but alternatively can be polyester of that denier. The use of a multifilament normal strength liquid crystal polymer fiber strand, such as Vectran M fiber strand, in the core is advantageous. Multifilament strand is very linear and slides and/or flows well relative to any other part of the core during fabrication and

subsequent use of an article of apparel produced therewith. The normal strength multifilament core strand, which is relatively unstretchable, takes a great deal if not the major part of the tensile load to which the yarn is subjected during knitting. It also appears to increase the flexibility of the core part of the yarn over an all metal core and in turn makes the yarn more easily knit, i.e., imparts to the yarn greater knittability. It also improves cut-resistance. The use of multifilament normal strength liquid crystal polymer fiber such as Vectran M fiber as a wrapping contributes significantly to the cut-resistance of the yarn. The first wrapping 12 provides a desirable rigid backup surface for the outer wrappings 14, 16, each of which tends to fill out the valleys of the wrapping immediately therebeneath. The multifilament wrappings 12, 14, 16 wind flat about the core, producing a yarn with a smooth surface that aids the knitting process and that has a good appearance, a non-abrasive surface, and provides heat resistance and maximum comfort. A cut-resistant protective glove machine-knitted from such a yarn is shown in Figure 7.

Issue

Would the subject matter of the rejected claims have been obvious under 35 USC Section 103 over Bettcher 4,470,251 in view of Robins et al. 4,912,781 to one of ordinary skill in the art at the time the present invention was made?

More particularly, does Robins et al. disclose the use of normal strength Vectran M and make obvious the use of that material as a substitute for high strength aramid (Kevlar) in the Bettcher yarn construction for cut-resistant protective gloves?

Grouping of Claims

With respect to the rejection, the rejected claims stand or fall together.

Argument

a. Introduction

Synthetic fibers of high tenacity, viz., greater than 10 grams per denier and particularly greater than 15 Or 20 grams per denier, exhibit high cut-resistance, making them suitable from that standpoint for fabricating composite cut-resistant yarns for use in forming protective fabric. Aramid (Kevlar) fibers, extended chain polyethylene (Spectra) fibers, and high strength liquid crystal polymer (Vectran HS) fibers were recognized for their cut-resistant properties at the time the present invention was made. All exhibit high tenacity, about 20 or more grams per denier. Low tenacity synthetic fibers, i.e., having a tenacity of no greater than 10 grams per denier, such as nylon, polyethylene and polyester, exhibited significantly lower cut-resistance. The appellant has discovered that a normal tenacity synthetic liquid crystal polymer fiber available under the trademark Vectran M provides high cut-resistance to composite yarns, for use in cut-resistant apparel, comparable to that of high tenacity synthetic fibers previously and presently used for manufacturing cut-resistant yarns, and in many ways has other superior features making it a desirable substitute for Kevlar, Spectra and Vectran HS.

Appellant is not aware of, and the examiner has not cited, any disclosure or teaching by which the phenomenon of cut resistance may be predicted from physical or chemical characteristics of synthetic fibers, although three synthetic fibers of high tenacity have exhibited cut-resistance and no normal tenacity fibers have been cited

as having high cut-resistance.

b. Basis of the Final Rejection

The final rejection of the appealed claims as obvious over Bettcher 4,470,251 in view of Robins et al. 4,912,781 is asserted on the following basis:

> "Claims 1-3, 5, 6, 11, 12, 15-18, 25, 26, 35 and 36 are rejected under 35 U.S.C. § 103 as being unpatentable over Bettcher ('251) in view of Robins et al. Bettcher ('251) discloses a cut resistant yarn as that claimed by the applicant with the exception of disclosing the use of Kevlar for the core fiber component and the first wrapping layer. Robins et al disclose a cut resistant yarn utilizing either Kevlar or Vectran liquid crystal polymer fiber. It would have been obvious to one of ordinary skill in the art to exchange the Kevlar in both the core and the first layer in Bettcher ('251) for the Vectran liquid crystal polymer fiber in view of Robins et al so that the yarn produced will have a greater cut or abrasion resistance as well as other property improvements such as flexibility and suppleness thereby providing a higher quality glove therefrom. Note that the liquid crystal polymer disclosed in Robins et al would inherently possess the property of a tenacity which is no more than 10 grams per denier. If however, the liquid crystal such as Vectran does not inherently possess the property of having a tenacity of no greater than 10 grams per denier, it would have been obvious to utilize the type of Vectran M fiber which does have this property as a matter of engineering choice of materials

having known properties depending upon the cost and properties desired in the final product produced from the yarn since Vectran M is less expensive than Vectran HS."

c. The Error in the Final Rejection

The error in the examiner's rejection is, first, that it is based on a false premise that Robins et al. disclose the Vectran species Vectran M (normal strength liquid crystal synthetic fiber), and second, that it is based on an erroneous conclusion that it would have been obvious to substitute a normal strength fiber for the high strength aramid fiber (Kevlar) to achieve high cut-resistance and other desirable features such as abrasion resistance in the Bettcher yarn construction when nothing teaches or suggests that a normal strength fiber will achieve comparable cut-resistance to high strength fibers.

d. Specific Limitations in the Claims On Appeal That Are Not Described in the Prior Art Relied Upon in the Rejection

The claims on appeal all recite a core element or wrapping element that is comprised of a liquid crystal polymer fiber having a tenacity of no more than 10 grams per denier.

e. The Deficiencies of the References in Supporting the Examiner's Rejection

The cited Bettcher patent '251 discloses a cut-resistant yarn comprised of wire and high strength aramid fiber. The examiner recognizes that it fails to disclose a liquid crystal polymer fiber having a tenacity of no more than 10 grams per denier

or that a low strength fiber would be cut-resistant in the same or similar sense that Kevlar is.

The cited Robins et al. patent also fails to specifically disclose a liquid crystal polymer fiber having a tenacity of no more than 10 grams per denier or that a low strength fiber would be cut-resistant to the same or similar extent that high strength synthetic fibers are.

There is no mention of Vectran or liquid crystal polymer in the Robins et al. specification. The only mention is in the claims. Claims 8 and 18 mention core yarn fibers of Vectran (generically) along with Spectra and Kevlar, which are high strength synthetic fibers, and along with olefin, nylon or polyester, which are low strength fibers. Claims 10 and 20 recite a covering yarn of steel metallic or any of the high strength materials like fiberglass, Vectra, Kevlar or Spectra. These claims must be considered in the light of the description in column 3, lines 23-34 where the core is characterized as "preferably a high strength multifilament yarn" and the cover yarn is "an abrasion and cut resistant monofilament strand such as stainless steel, or a high strength multifilament yarn." No one skilled in the art would find this to be a disclosure of normal strength Vectran. On the contrary, it is clear from the description of the cover yarn and consistent with the description of the core yarn, that the term "Vectran" as used in the claims refers to a high strength yarn.

The examiner nevertheless contends that the Robins et al. disclosure, because it mentions "Vectran," inherently discloses a liquid crystal polymer having a tenacity of no more than 10 grams per denier. He also contends that if the Vectran mentioned in Robins et al. does not inherently have a tenacity of no more than 10 grams per denier, it would have been obvious to select the type of Vectran M fiber

which does have that property as a matter of choice. Neither alternative is correct.

The generic term "Vectran" does not specifically disclose the normal strength species Vectran M. The asserted obviousness of selecting the normal strength Vectran M species rather than the high strength Vectran HS species ignores the necessity of a motivation for the substitution of a normal strength fiber for the high strength fiber of Bettcher, and foreseeability of the result. See, e.g., In re Gordon, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984) ("The mere fact that the prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification.") No prior art suggests the desirability of substituting a normal strength synthetic fiber for a high strength fiber to achieve high cut-resistance.

The examiner, on page 3 of Paper No. 9, states that it would have been obvious to exchange the Kevlar in the core and wrap of Bettcher with Vectran in view of Robins et al. so the yarn "may have a greater cut-resistance as well as other property improvements."

The examiner has cited nothing to support that statement. There is no evidence or any claim by appellant that such a substitution would produce greater cut-resistance. Also, the word "may" is revealing, because it indicates that, at most, the rejection is directed to an "obvious to try" standard, not the standard of Section 103, which requires predictability. See, e.g., In re Geiger, 815 F.2d 686, 688; 2 USPQ2d 1276, 1278 (Fed. Cir.1987), and In re Lilly & Co., 902 F.2d 943, 945, 14 USPQ2d 1741, 1743 (Fed. Cir. 1990) where the court indicated that,

> "[a]n 'obvious to try' situation exists when a general disclosure may pique the scientist's curiosity, such that further investigation might be done as a result of the disclosure, but the disclosure itself does not contain a sufficient

teaching of how to obtain the desired result, or that the claimed result would be obtained if certain directions were pursued."

A principal shortcoming of the examiner's contention is that no specific disclosure is made by Robins et al. of any normal strength Vectran, much less a distinction between liquid crystal polymer fibers having a tenacity of no greater than 10 grams per denier (e.g., Vectran M) and those having greater tenacity (e.g., Vectran HS). Therefore, Robins et al. does not teach an equivalence between Vectran M and Kevlar. This is especially true where as here the species of Vectran have at least one decidedly different characteristic (tensile strength or tenacity) that would appear from prior art to be functionally significant. Vectran M shares the property of low tenacity or strength with other fibers, such as polyester, not considered cut-resistant; yet, Vectran M performs with a level of cut-resistance comparable to high strength synthetic fibers, an unexpected and advantageous property. This is shown by the test results set forth in appellant's declarations under Rule 132.

Evidence of unexpected advantageous properties may rebut a prima facie case of obviousness based on structural similarities. In re Papesch, 315 F.2d 381, 386; 137 USPQ 43, 48 (CCPA 1963). Such evidence may include data showing that a compound is unexpectedly superior in a property it shares with prior art compounds. In re Lunsford, 357 F.2d 380, 148 USPQ 716 (CCPA 1966). See, In re Chupp, 816 F.2d 643, 2 USPQ2d 1437 (Fed. Cir. 1987).

The examiner also states in his "Response to Amendment" in Paper No. 9 that, "if a tougher and more cut resistant product is desired then it would have been obvious to [substitute Vectran HS?] for the yarn of higher tenacity materials, and if less strength is necessary and a softer more comfortable product is desired then it

would have been well within the skill of one of ordinary skill in the art to form the yarn of materials having a lesser tenacity and a softer hand." That reasoning, of course, supports patentability of the rejected claims. Appellant wants and achieves a highly cut-resistant product, yet accomplishes that through the unobvious use of normal strength liquid crystal polymer fiber. See page 2, lines 15-21 of appellant's specification, where the first mentioned feature of the invention is that it provides a cut-resistant knittable composite yarn using a yarn or fiber of normal strength made from Vectran liquid crystal polymer, to provide a composite yarn of comparable high cut-resistance to composite yarns of similar construction that utilize high strength synthetic yarn or fiber. See also page 6, lines 21-25, and page 19, lines 16-22.

Nothing cited by the examiner suggests that use of normal strength Vectran will provide comparable cut-resistance to high strength fibers of known cut-resistance. The examiner's argument, that one would substitute a high strength fiber to achieve high cut-resistance, undercuts the contention that it would have been obvious to substitute normal strength Vectran M for high strength Kevlar to achieve high cut-resistance. The present invention evidences the lack of predictability and knowledge in the art of what material characteristics or properties will impart high cut-resistance. It is apparent that the rationale set forth by the examiner does not support the obviousness rejection.

f. Evidence Comparing Cut-Resistance of Normal Strength Liquid Crystal Polymer Fiber and Other Normal Strength and High Strength Synthetic Fibers

A declaration and supplemental declaration under Rule 132 (37 CFR 1.132)

were submitted attesting to the unobviousness of the claimed subject matter over the cited references. Test results are set forth to show that a fabric knitted from yarn of the construction shown and claimed in this application, utilizing a core and a first and second wrapping, at least one of which is a liquid crystal polymer fiber having a tenacity of no more than 10 grams per denier, has greater cut-resistance than a fabric knitted from a comparable yarn in which a high strength stretched polyethylene fiber (Spectra) is used in place of the liquid crystal polymer fiber. The test results also show the low cut-resistance achieved with polyester, a typical normal strength synthetic fiber. Details of the tests and comparison test results are set forth in the two declarations. Questions raised by the examiner in connection with the first declaration are answered in the supplemental declaration.

The declarations point out that heretofore applicant and insofar as he is aware, others, regarded the cut-resistance found to exist with Kevlar and Spectra to be superior to that of other fibers made of synthetic materials, due to the extremely high tenacity of Kevlar and Spectra.

The manufacturer of Vectran, Hoechst Celanese, refers to Vectran HS, which has a tenacity of 23 grams per denier, as a high strength fiber, while it refers to Vectran M, which has a tenacity of 9 grams per denier, only as a "high performance" fiber. See the brochure submitted to the examiner entitled "Vectran Liquid Crystal Polymer Fiber, first page, right hand column, lines 10-14. Its description of fiber elsewhere under the generic term "Vectran" does not import the characteristics of the species Vectran HS to the species Vectran M. It is not clear to what use Vectran M with its low tenacity will be put other than "for applications requiring high impermeability, excellent property retention over a broad temperature range, and

low moisture absorption." See second page of brochure, right hand column, under "Composites."

Applicant contends that the examiner has cited no teaching or disclosure that the characteristics of Vectran M provide high cut-resistance on the order of Kevlar, Spectra or Vectran HS. Applicant has shown by comparison tests that Vectran M has provided a cut-resistance greater than Spectra provides in a fabric knitted from yarn constructed in accordance with the claimed invention. This property and hence the claimed yarn was not obvious from the prior art.

Conclusion

There is a total absence in the prior art relied upon that there is a normal strength Vectran that is cut-resistant to an extent that would make it suitable and obvious as a replacement for aramid in the cut-resistant yarn of Bettcher '251.

The final rejection must be reversed and claims 1-3, 5, 6, 11, 12, 15-18, 25, 26, 35 and 36 allowed.

Respectfully submitted,

Date: Dec 17, 1998

James G. Watterson
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APPENDIX

The Claims on Appeal:

1. A cut-resistant yarn suitable for machine knitting, comprising a core, a first wrapping about the core and a second wrapping about the first, at least one of said core, first wrapping and second wrapping being comprised of liquid crystal polymer fiber having a tenacity of no more than 10 grams per denier.

2. A cut-resistant yarn as set forth in claim 1 wherein the core is comprised of said liquid crystal polymer fiber.

3. A cut-resistant yarn as set forth in claim 1 wherein the first wrapping is comprised of said liquid crystal polymer fiber.

5. A cut-resistant yarn as set forth in claim 2 wherein one of the first and second wrappings is comprised of synthetic fiber having a tenacity no greater than 10 grams per denier.

6. A cut-resistant yarn as set forth in claim 5 wherein said synthetic fiber of said one wrapping is said liquid crystal polymer fiber.

11. A cut-resistant yarn as set forth in any one of claims 1-10, including a flexible metal strand having a diameter of from 0.001 to 0.010 inch.

12. A cut-resistant yarn as set forth in claim 11 wherein the metal strand is a core element.

15. A cut-resistant yarn as set forth in any one claims 1, 3, 4, 8 or 9 wherein a flexible metal strand and a fiber strand comprise the core.

16. A cut-resistant yarn as set forth in claim 11 wherein the flexible metal strand is annealed stainless steel.

17. A cut-resistant yarn suitable for machine knitting having: a core comprised of a liquid crystal polymer fiber having a tenacity of no more than 10 grams per denier; a flexible metal strand; a wrapping of liquid crystal polymer fiber having a tenacity of no more than 10 grams per denier, and one or more additional wrappings of synthetic fiber none of which has a tenacity greater than 10 grams per denier.

18. A cut-resistant yarn as set forth in claim 17 wherein the metal strand is annealed stainless steel of a diameter from 0.001 to 0.006 inch, the liquid crystal polymer fiber of the core and wrapping each has a denier of from 200 to 3000, and each of the one or more additional wrappings of synthetic fiber has a denier of from 200 to 1500.

25. A cut-resistant yarn suitable for machine knitting having a core

comprised of a liquid crystal polymer fiber having a tenacity of no more than 10 grams per denier and a strand of wire, and having wrappings comprised of a wrapping of liquid crystal polymer fiber having a tenacity of no more than 10 grams per denier, and two wrappings each of which is either nylon or polyester over the liquid crystal polymer wrapping.

26. A cut-resistant yarn as set forth in claim 25 wherein the strand of wire is stainless steel having a diameter of from 0.001 to 0.006, the liquid crystal polymer fiber of the core and of the wrapping have a denier of from 200 to 3000, and each of the said two wrappings has a denier of from 200 to 1500.

35. A cut-resistant yarn as set forth in any one of claims 1-3, 5, 6, 17, 18, 25 or 26 knitted to form an article of protective apparel.

36. A yarn as set forth in claim 35 wherein the article is a cut-resistant protective glove.